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Cold versus Hot Tonsillectomy: State of the Art and Recommendations

Hannah Blanchford David Lowe

James Cook University Hospital, Middlesbrough, UK

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Tonsillectomy, paediatric · Diathermy · Coblation · Haemorrhage

Abstract
An investigation of the risk factors for haemorrhage after tonsillectomy with particular reference to the use of bipolar diathermy for tonsillar dissection and haemostasis, diathermy power settings and coblation tonsillectomy. The findings of the National Prospective Tonsillectomy Audit and subsequent related research are summarised and discussed with reference to the issue of use of hot versus cold tonsillectomy techniques. Additional unpublished data on coblation tonsillectomy is presented. Overall, increased haemorrhage rates were noted for diathermy dissection tonsillectomy (adjusted odds ratio 2.47, $p < 0.0001$) and coblation tonsillectomy (adjusted odds ratio 3.07, $p < 0.0001$) compared to the reference category of cold steel tonsillectomy. Use of bipolar diathermy for haemostasis only carried an intermediate risk of haemorrhage (adjusted odds ratio 1.57, $p = 0.004$). Further investigation of diathermy power settings demonstrated a quantitative relationship between increasing power usage and subsequent haemorrhage. Use of diathermy for haemostasis at the lowest effective setting may carry a comparable risk of haemorrhage to that of cold steel tonsillectomy. Recommendations are given on the optimum tonsillectomy technique for both the older child or adolescent and the particularly young or low weight child.

David Lowe in association with the National Prospective Tonsillectomy Audit, Royal College of Surgeons of England.

David Lowe, MD, FRCS, FRCS(ORL-HNS)
James Cook University Hospital
Middlesbrough (UK)
E-Mail tonsils@gmail.com

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Introduction

Having been asked to discuss cold versus hot techniques in the light of my previous work on the National Prospective Tonsillectomy Audit (NPTA), I felt this an ideal opportunity not only to give an overview of the best tonsillectomy practice in terms of diathermy usage in dissection and/or haemostasis, but also to reconsider the issue of coblation tonsillectomy. Some additional unpublished data on coblation is discussed, and recommendations are made on the optimum tonsillectomy technique according to patient age and comorbidity. The paper draws on this as well as other unpublished data, as well as data from my MD thesis and main previous NPTA publications.

Background

Electrodissection, or 'hot' tonsillectomy techniques, were introduced in the 1990s and rapidly gained in popularity. The NPTA was set up to investigate concerns over a general increasing trend year on year in haemorrhage after tonsillectomy. Data was collected through 2003 and 2004 in England and Northern Ireland. It was expected that the quality of disposable instruments introduced in the UK (to avoid theoretical transmission of Creutzfeldt-Jakob disease) might have led to these increases, but excessive use of diathermy was later pinpointed as the main cause for increasing rates of haemorrhage after tonsillectomy [1]. During the NPTA, ENT-UK and the National Institute for Clinical Excellence (NICE) jointly issued guidance recommending limited diathermy usage to ENT surgeons. The study collected data on almost 40,000 paediatric and adult tonsillectomy patients. Data collected after the guidance on limiting diathermy usage demonstrated a definite reduction in haemorrhage rates [1].

This paper will further consider the possible differences between use of diathermy of different types for tonsillar dissection and/or haemostasis and also consider the coblation technique for tonsillectomy which was introduced in 2001. Coblation tonsillectomy has met with mixed reviews and contradictory evaluations on safety and efficacy [2–4].

The methodology applied here is described in detail in the final report of the NPTA and related clinical papers [1, 5]. Data collection involved a novel online secure electronic transfer to an encrypted database at the Royal College of Surgeons of England.

Data on patient characteristics including age, sex and indication for surgery was collected as well as detailed information on surgical techniques, instrumentation and details of diathermy usage.

Cold Tonsillectomy: The Gold Standard?

Throughout the NPTA results and analyses, cold steel tonsillectomy (using traditional means only for both tonsillar dissection and haemostasis) was seen as the gold standard. The haemorrhage rate for cold steel tonsillectomy was used for comparison of all other techniques and calculation of odds ratios for these alternatives [1, 5].

The benefits of predictably low haemorrhage rates with this technique, particularly with the use of surgical ties for haemostasis, led both to the recommendation in the UK that this technique be adopted as the gold standard, and changes for the focus of training of junior surgeons. It was felt that junior ENT doctors should become proficient in cold steel dissection and application of surgical ties as their main surgical technique. Only after achieving this are most ENT trainees in the UK allowed to develop skills in alternative (hot) tonsillectomy techniques [1, 5].

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In general, the frequency of posttonsillectomy haemorrhage was lowest in the cold steel group. Haemorrhage in these patients also appeared less severe in the NPTA data (with fewer returns to the operating theatre). In terms of timing of haemorrhage following surgery, the latest postoperative haemorrhages recorded in the NPTA data generally occurred in cases of 'hot' tonsillectomy. The latest recorded haemorrhages occurred more than 3 weeks after surgery. In the case of cold steel tonsillectomy, the latest secondary haemorrhages occurred little more than a week after surgery [unpubl. data].

From the NPTA data, the cold steel technique had a much reduced secondary haemorrhage rate but a slightly higher primary haemorrhage rate. Diathermy usage appeared protective against primary bleeding but a substantial risk factor for secondary haemorrhage [5].

Summary of Data on Technique, Diathermy Dissection and Haemostasis

The NPTA demonstrated use of hot tonsillectomy techniques as a risk factor for subsequent haemorrhage after tonsillectomy. Particular patient characteristics (including increasing age and indication for surgery) were also associated with haemorrhage. These multiple influences mean that unadjusted complication rates may not accurately reflect the relationship between outcome and a single factor such as usage of diathermy. To overcome this, the NPTA developed a risk model using multilevel multiple logistic regression. The multilevel approach takes account of the fact that differences in outcomes among patients treated at the same NHS hospital are likely to vary less than outcomes among patients treated at different hospitals [1].

Among the patient factors, this risk model suggests that the risk of haemorrhage increases with age and the risk is lower in females compared to males. A summary of the risk model appears in table 1 below. Patients with pharyngeal obstruction also had lower haemorrhage rates than patients with recurrent acute tonsillitis. The adjusted postoperative haemorrhage rates when a 'hot' technique was used for both dissection and haemostasis (diathermy or coblation) were all between 2.4 and 3.2 times higher than in the cold steel group. The postoperative haemorrhage rates when diathermy was used only for haemostasis were around 1.5 times larger. These findings suggested a possible dose-response effect between the amount of diathermy energy used and the resultant haemorrhage risk via a process of collateral thermal tissue injury and subsequent necrosis [1, 5–7].

Diathermy Power Settings

NPTA data on diathermy power settings used either for tonsillar dissection or haemostasis was considered in great detail. Patients operated with cold steel dissection and subsequent diathermy haemostasis were found to be the most sensitive indicator of a possible relationship between diathermy and postoperative haemorrhage. Those in whom diathermy was used for dissection and haemostasis were found to be at higher risk of haemorrhage throughout, irrespective of diathermy power settings [6, 7].

Of particular importance, when very low power settings were used for diathermy haemostasis, it was found that overall haemorrhage rates were comparable to that of cold steel tonsillectomy (with no diathermy at all) at 1.8%. Potentially, in such cases, the risk of primary haemorrhage in the initial few hours after surgery is greater in the cold steel group with no diathermy usage. This is likely the result of the risk of slipping of ligatures in this group during the patient's initial recovery. Those operated with the same technique but high diathermy power settings had more than double the rate of haemorrhage at 3.7% (p value for trend 0.005) [6].

Table 1. Risk model for tonsillar haemorrhage

Risk factor	Adjusted odds ratio	p value
Surgical technique		
Cold steel and ties/packs	1	
Cold steel and monopolar diathermy	1.62 (1.03–2.54)	0.03
Cold steel and bipolar diathermy	1.57 (1.16–2.13)	0.004
Monopolar diathermy forceps	2.71 (1.63–4.49)	0.0001
Bipolar diathermy forceps	2.47 (1.81–3.36)	<0.0001
Bipolar diathermy scissors	3.20 (2.09–4.90)	<0.0001
Coblation	3.07 (2.03–4.65)	<0.0001
Other	2.48 (1.62–3.79)	<0.0001
Age, change in risk per year	1.02 (1.02–1.03)	<0.0001
Sex		
Male	1	
Female	0.82 (0.73–0.93)	0.002
Indication for surgery		
Record of acute tonsillitis	1	
Chronic tonsillitis	1.05 (0.84–1.31)	0.7
Previous quinsy	1.06 (0.74–1.53)	0.8
Pharyngeal obstruction	0.46 (0.33–0.63)	<0.0001
Other	0.46 (0.26–0.81)	0.007

Figures in parentheses indicate 95% CI. From NPTA final report [1].

Coblation Tonsillectomy and the 'Learning Curve'

From the risk model, we see that the overall adjusted odds ratio for coblation tonsillectomy supports a threefold increase in risk of haemorrhage compared to cold steel tonsillectomy. Interestingly, whereas diathermy usage appeared to be protective against primary haemorrhage and to carry an increased risk of secondary haemorrhage, for coblation, both primary and secondary haemorrhage rates were high, when compared to cold steel tonsillectomy.

Of the 33,921 tonsillectomies submitted to the NPTA, there were 1,565 (4.6%) operations performed using coblation [1]. The number of operations performed in NHS and independent hospitals were 1,379 (88%) and 186 (12%). Operations using coblation were performed at 48 different hospitals in England and Northern Ireland. The use of coblation at these hospitals varied substantially. It ranged between exclusive use of coblation at some (100%) and coblation used in less than 5% of cases at a few hospitals [unpubl. data].

There were 77 teams within individual NHS hospitals that used coblation for tonsillectomy. Among the 77 teams, 14 (18%) used coblation in more than 75% of tonsillectomies. There were 40 (52%) teams that used coblation in less than 20% of operations, and the proportion was under 10% for 30 (39%) teams. It is likely that teams with a low proportion may have been evaluating the technique during the NPTA and, through being low on a learning curve, may have produced high rates of postoperative haemorrhage. The teams that used coblation extensively tended to be within the same NHS hospital. Little change in use of coblation was identified after NICE/ENT-UK produced national guidance favouring cold steel tonsillectomy [8].

Interestingly, the majority of coblation tonsillectomies were performed by consultant surgeons. Other techniques had higher rates of junior operating surgeons. No obvious differences in patient characteristics were seen among those operated by coblation techniques but coblation was associated with a slightly greater use of day surgery [unpubl. data].

From the NPTA data, in NHS hospitals, there were 71 haemorrhages in 1,379 coblation operations, giving an overall haemorrhage rate of 5.1% (95% CI = 4–6.5%). Looking at individual centres however, rates varied between 1 and 15%. If there was a marked learning curve effect for coblation tonsillectomy, it might be expected that those hospitals with few operations might have a higher haemorrhage rate; however, this was not found to be the case [unpubl. data].

At 2 hospitals, haemorrhage rates were found to be particularly high (more so than that expected from random variation). Both were hospitals at which coblation was commonly used, but complication rates for coblation were around double that seen for other tonsillectomy techniques in the same hospitals. Further evaluation suggested that more junior surgeons were operating in many of these cases and a learning curve effect might at least partly explain these findings. A final analysis of haemorrhage rates for coblation operations used information about a trainee supervision by a senior surgeon to examine the likelihood of a learning effect. It was found that where junior or less experienced surgeons operated, supervised by a consultant, the haemorrhage rate was overall elevated. The haemorrhage rate for these supervised coblation tonsillectomies was 11.2% compared to 3.4% for those unsupervised.

Third, multiple logistic regression was used to estimate the effect of 'supervision' in conjunction with other risk factors: age, sex, indication, surgical grade, surgical technique, and time of operation (before or after NICE/ENT-UK guidance). The odds ratio of haemorrhage for supervision was 1.37 (95% CI = 1.17–1.60, $p < 0.001$). The odds ratio fell slightly to 1.30 if the 2 outlier hospitals were removed from the sample, but remained statistically significant (95% CI = 1.11–1.54, $p = 0.001$) [unpubl. data].

Recommendations – The Young or Low Weight Child

In a child under the age of 3–4 years, or one of particularly low weight (and hence low circulating blood volume), these considerations may rightfully lead to adoption of an alternative hot technique for tonsillectomy. Use of bipolar diathermy for both dissection and haemostasis can be recommended (with careful application of diathermy at the lowest effective setting). This is because any small increase in risk of secondary haemorrhage is firstly minimised in this particularly young age group, but also balanced by a reduced primary haemorrhage rate and the ability to perform an essentially bloodless tonsillectomy (where even a small intra-operative blood loss could be troublesome and result in early shock for the patient) [6].

In such a patient group, a completely cold tonsillectomy can be counterproductive with relatively high intra-operative blood loss. It may therefore be sensible to consider a hot tonsillectomy technique in those with a body mass less than 15 kg (where circulating blood volume is little more than a litre), or indeed where other factors influence this decision (the syndromic child, bleeding disorders, or other risk factors for haemorrhage).

Recommendations – The Older Child, Adolescent or Adult

In the older child or adult (where some intra-operative blood loss is more acceptable), a tonsillectomy technique involving traditional cold steel dissection may be considered or preferred. In the older child, above a mass of 15 kg, the decision on technique may still be influenced by all the relevant factors as well as personal preference. Use of diathermy for haemostasis only after cold steel dissection may also prove beneficial. Judicious use of bipolar

diathermy at the lowest effective power setting has been shown to be comparable in terms of haemorrhage risk to a totally 'cold' technique [6]. With this in mind, personal preference or extent of intra-operative bleeding may readily dictate a decision between diathermy haemostasis and application of surgical ties. The importance of packing the tonsillar fossa, and patience on the part of the surgeon, allowing haemostasis should never be underestimated.

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